



## NREN - Quality of Service Update

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### Agenda



- Traffic Conditioners
- IP to ATM Class of Service
- Bandwidth Reservation
- QoS Network Measurements

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## Traffic Conditions



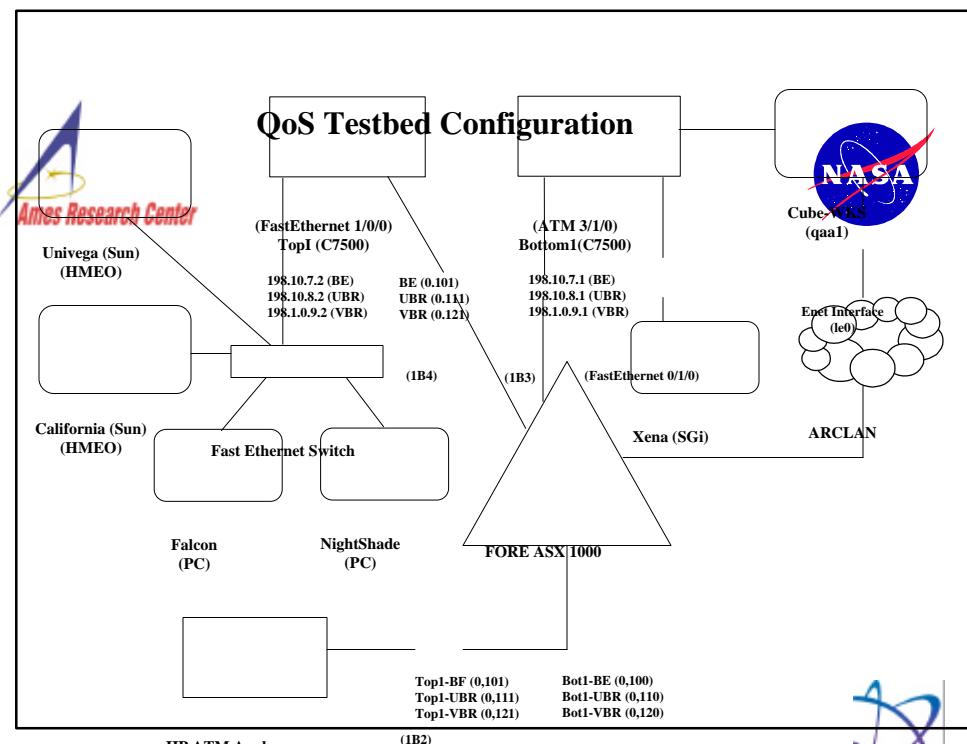
## Objective

- **Test Traffic Conditioning (TC) mechanisms to provide IP resource reservation for IPG data flows**

### Approach

- Test Cisco traffic conditioners in a lab environment
  - Test Applications in a lab environment
  - Run tests across the WAN with Applications
  - Test/integrate router based TC Functions with IPG data flows

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## Equipment



- **Cisco 7500 Series top1s**

IOS versions 12.0(1,3)T, 12.0(4) dTS beta  
VIP2-50, ATM Deluxe PA's

- **Fore ASX-1000**

ForeThought 6.0

- **HP ATM Analyzer**

- **Sun/SGi Workstations/Multiple PCs**

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## Traffic Sources



### Multiple Traffic Sources used:

- “nttcp” for low-end measurements - tcp and udp
- Chariot Software module -tcp and udp
  - allows for multiple streams between a source and destination
- vDOC experimental traffic
  - multicast streams at different rates -- up to 50Mbps
- Unicast traffic generator (gen\_send and gen\_receive)
  - [http://www.citi.umich.edu/u/andros/qbone\\_test1/qbone\\_test1.html](http://www.citi.umich.edu/u/andros/qbone_test1/qbone_test1.html)

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## Traffic Conditioners



- **Police/Classify/Mark Traffic**  
CAR /IP-to-ATM Class of Service
- **Queuing/Dropping**  
WFQ and WRED
- **Shaping**  
dTS (distributed traffic shaping)

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## Traffic Shaping



- **dTS provides two types of shape commands: average and peak.**
  - Traffic descriptors defined by CIR (mean rate), Bc (burst size), and Be (excess burst size)
  - The excess burst size (Be) allows more than the burst size (Bc) to be sent during a time interval
- **When shape average is configured, the interface sends no more than the burst size (Bc) for each interval, achieving an average rate no higher than the mean rate**
- **When shape peak is configured, the interface sends Bc plus Be bits in each interval.**

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## IP to ATM Class of Service



### Current Architecture

- NREN Shares Bandwidth with NASA Operational Networks
  - NISN SIP (NASA Internet)
  - NISN PIP
- Shared ATM Service from Sprint
  - Mostly OC-3
  - Can Purchase UBR, VBR & CBR PVC's
- NISN Uses UBR PVC's

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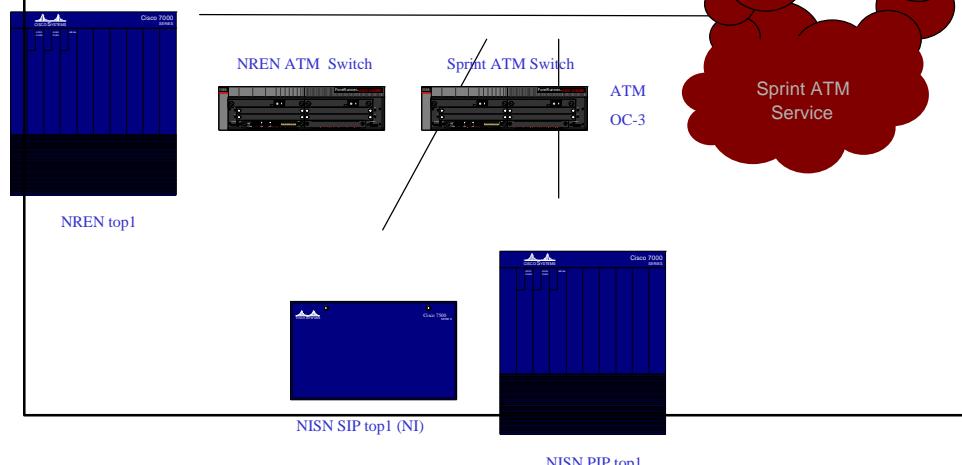


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## IP to ATM Class of Service



### Description: NASA NREN/NISN Bandwidth Sharing





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## IP to ATM Class of Service



### Objective

- Mapped IP-Based Reserved Flows to VBR

### Approach

- Test Cisco ATM Bundle Feature for IP-to-COS Mappings
- Test NASA Applications across VBR in Lab Environment
- Run VBR tests across the WAN with Applications
- Integrate IP-to ATM COS with Traffic Conditioning Functions



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## IP to ATM Class of Service



### Status

- Cisco ATM Bundles working in Lab
- IOS 12.0 (3)T
- No Noticeable Performance Hits when using ATM Bundles
  - Bandwidth values consistent with normal sub-interfaces
  - Latency values consistent with normal sub-interfaces



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## Some configs ...



**traffic shaping (currently in beta)...**

```
top1(config)# class-map class-interface-all
top1(config-cmap)# match any
top1(config-cmap)# exit
top1(config)# policy-map dts-interface-all-action
top1(config-pmap)# class class-interface-all
top1(config-pmap-c)# shape average 10000000
top1(config-pmap-c)# exit
top1(config)# interface fe1/0/0
top1(config-if)# service-policy output dts-interface-all-action
```



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## IP to ATM Class of Service



### Cisco ATM Bundle Configuration

```
!
interface ATM3/0/0.2 point-to-point
description UBR Test top-1-ubr -> 198.10.8.2
ip address 10.10.8.1 255.255.255.0
ip pim sparse-dense-mode
ip igmp static-group 234.5.6.7
bundle UBR-15Mbps
    class-bundle UBR-15-Class
    protocol ip 10.10.8.2
    broadcast
    encapsulation aal5snap
    pvc-bundle UBR-15-PVC 0/110
!
vc-class atm UBR-15-Class
    ubr 15000
```



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## IP to ATM Class of Service



### CAR with ATM Bundle

```
rate-limit input access-group 101 15000000 2000000 3000000 conform-action set-
precedence-transmit 1 exceed-action drop ( prec and dscp bits)
```

.....

```
vc-class atm UBR-15-Class (UBR+)
```

```
ubr 15000
```

```
no precedence
```

```
protect vc
```

```
!
```

```
vc-class atm VBR-20-Class
```

```
vbr-nrt 20000 10000 1000 20000 10000 1000
```

```
precedence 1
```

```
protect vc
```

```
access-list 101 permit ip host 198.10.7.130 any
```



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## Bandwidth Reservation

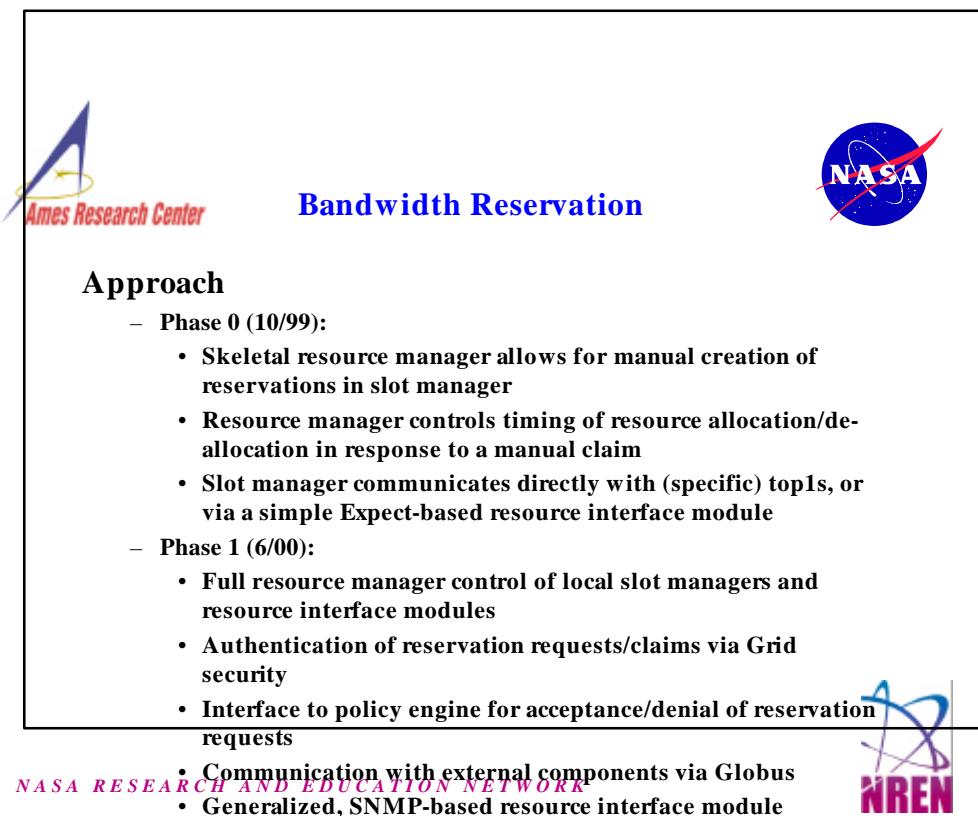
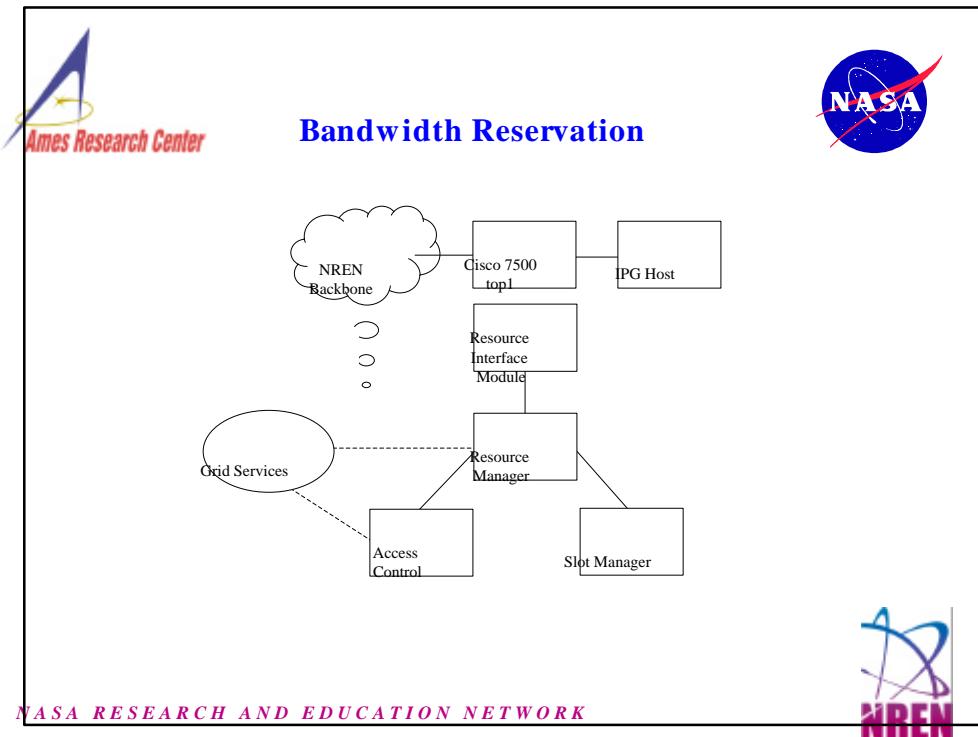


### Objectives

- Provide advance reservation of bandwidth “slots”
- specific bandwidth at a specific time for a specific duration
- Dynamically implement slot reservations using QoS features



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## Bandwidth Reservation



### Status

- Slot manager: done (ANL)
- Phase-0 resource manager: under development

### Next Steps

- Phase 0 resource interface module
- Testing/deployment of Phase-0 components in NREN testbed

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## QoS Measurement



- **Architect and deploy a monitoring and measurement system at selected locations**
  - Key element is IPG support
    - Discern effective use of QoS parameters
    - Intuitive display with near real-time
- **Provide mechanism for long-duration measurements (hours and days)**
- **General solution with applicability beyond IPG effort**

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**Overall Measurement Requirements**

**Traffic measurement details**

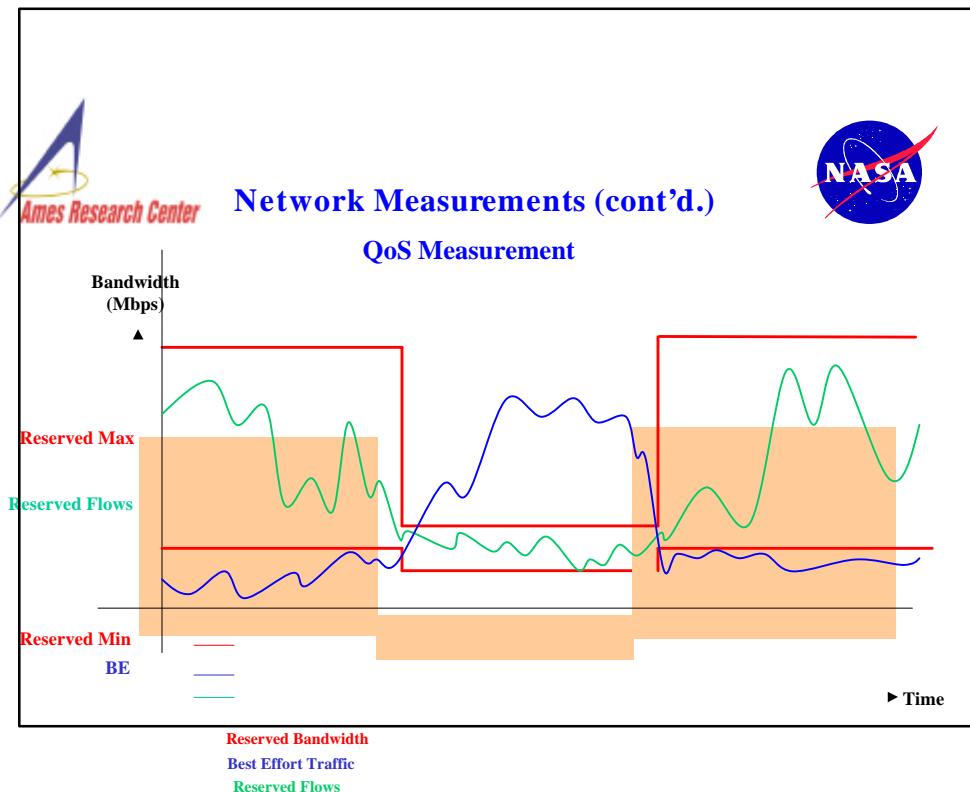
- Total bandwidth available
- Reserved bandwidth values
  - Maximum reserved and Minimum reserved
- Best Effort (BE) bandwidth used
- IPG flows - bandwidth used
- Latency (Round Trip Time [RTT])

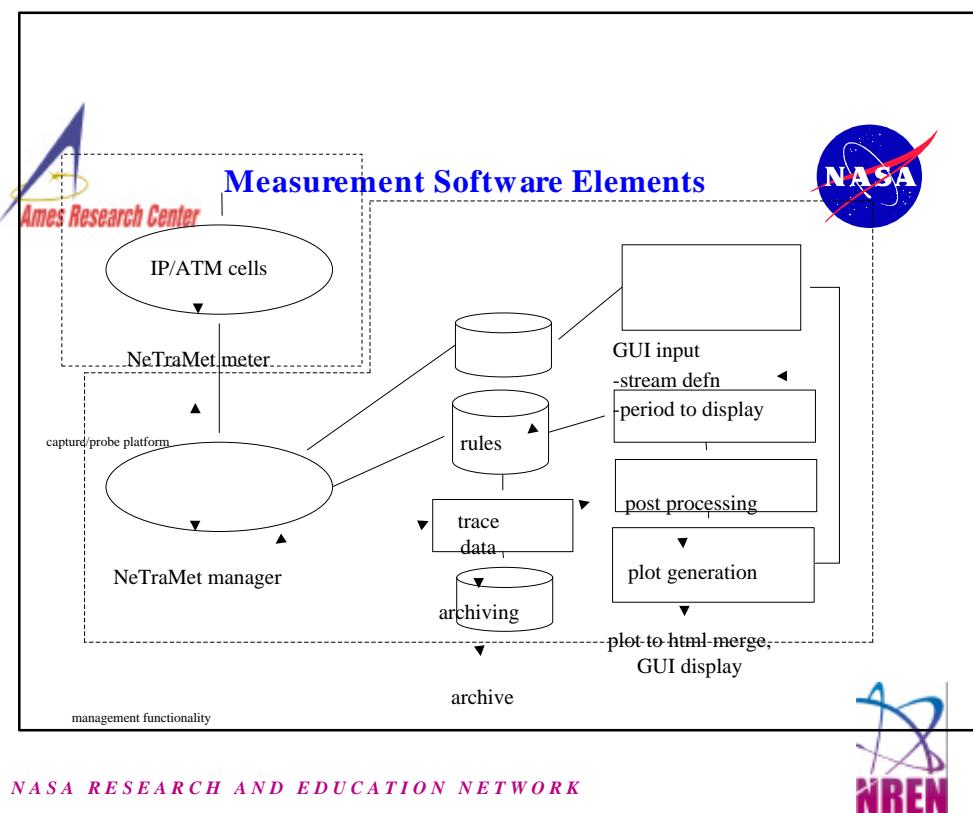
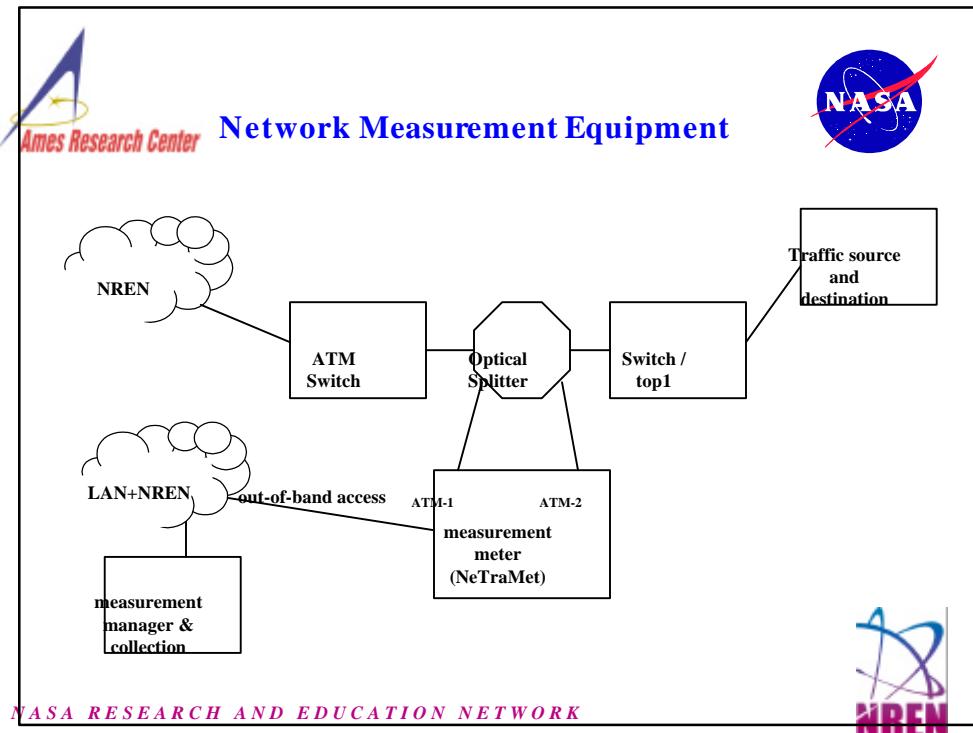
**Collection & Presentation**

- Web-based graphical representation
- Baselines:
  - Pre-QoS baselines
  - Application traffic baselines
- QoS test suite
  - Traffic measurements
  - Scheduled intervals

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## Work Progress



### Resources

- Measurement equipment
  - FreeBSD PC, dual ATM if's, optical splitter
- High speed out-of-band access

### Status

- Total bandwidth and BE utilization measurement methodology is determined
- Development needed to examine TOS byte and to build GUI

### Issues

- Retrieving reserved bandwidth from resource manager
- Measuring BE v/s IPG flows
- Understanding IPG application requirements
- Dependencies on bandwidth reservation scheme

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